A NEW GENUS OF FLIES POSSIBLY REFERABLE TO CRYPTOCHETIDAE (DIPTERA, SCHIZOPHORA)

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Abstract

Librella demetrius **n. gen. et sp.** is described from eastern Australia. A detailed morphological comparison with certain other acalyptrate flies is made, and it is suggested that *Librella* is a highly plesiomorphic (*sensu* Hennig) member of the family Cryptochetidae. Though this relationship is not obvious from comparison with the recent genus *Cryptochetum* Rondani, it is more apparent when the Oligocene cryptochetid genus *Phanerochaetum* Hennig is considered. The Cryptochetidae are perhaps best placed in the superfamily Drosophiloidea despite some points of disagreement with other included families.

Introduction

The new genus of flies described in this paper has been known to me for some years but its systematic position has been quite obscure. Recent study of a number of specimens has led to the rather surprising conclusion that its relationships may lie with the family Cryptochetidae. The only recent genus of this family previously recognized, *Cryptochetum* Rondani, includes species which were used in early biological control work on account of their predation on scale insects (Coccoidea). This genus still receives some attention due to its predatory habits on pest species.

The family position of *Cryptochetum* was formerly a matter of disagreement. Agromyzidae, Drosophilidae, Chamaemyiidae, Milichiidae, and Carnidae are families with which it has been associated. Brues and Melander (1932) separated it as a family Cryptochaetidae (more correctly Cryptochetidae), and this course eventually received general acceptance as indicating the isolated systematic position of the genus.

Librella n. gen.

Moderately small, stoutly built flies; general coloration dull fulvous-yellow with variable brownish markings; wings clear; cuticular surface largely pruinescent.

Head broad, compressed from front to rear; occipital region broadly excavated, except on lower part where it is almost flat; ptilinal suture not highly arched, medially only slightly higher than antennal sockets; face with a low, slightly angular median carina on most of its length, discontinued above between antennal sockets; subcranial cavity small, much broader than long; inner and outer vertical bristles well developed; postverticals short, well spaced, convergent; fronto-orbital bristles normally in 3 pairs, rather short, especially the anterior pair; ocellar bristles either subparallel and reclinate or widely divergent; vibrissae usually quite absent, but developed in one of the available specimens; postfrons and postgenal region setulose. Antennae rather widely separated basally; segments 1 and 2 short; segment 2 sinuate on dorsal distal margin with a shallow dorsal longitudinal groove; segment 3 large, broadly oval, compressed, with one sensory pit, attached to summit of distal prominence of segment 2 which is concealed in basal cavity of segment 3, without the concealed proximal dorsal prominence found in most Drosophiloidea etc.; arista moderately long, three-segmented, its distal segment with rather numerous minute hairs. Palpus rather short, thick, extending a little beyond epistomal margin; proboscis rather small, with short, broad labella.

Thorax stout, dorsally convex; scutellum almost as long as broad, rounded but with apex indistinctly angular, bare and slightly convex dorsally, not sharply margined, with

two subequal pairs of bristles, the apical ones crossed or strongly convergent, the la ones divergent, inserted slightly behind middle of scutellum; scutellar suture narrowly deeply incised; prosternum subtriangular (slightly broader than an equilateral triangle) narrow, distinctly sclerotized precoxal bridges; the following bristles present: humeral, notopleurals, supra-alar, postalar, a bristle between posterior notopleural and supra short weak posterior intra-alar, posterior dorsocentral and often also a shorter dorsoc close in front of it, prescutellar acrostichal and sometimes also a shorter acrostichal abo front of it, 2 long sternopleurals directed upwards and divergent; presutural bristle abs mesopleuron and pteropleuron bare. Legs slightly shorter and stouter than is usu *Drosophila*; fore femur with some posterodorsal and shorter posteroventral bristles; m femora without strong bristles; a preapical dorsal bristle on each tibia generally distinc able but very short; middle tibia with 2 or 3 apical ventral spurs; hind tibia with developed apical ventral spur-like setulae; tarsi somewhat longer than tibiae, with segments cylindrical; hind basitarsus thicker but not noticeably shorter than ne basitarsus. Wing remarkably *Drosophila*-like in shape and structure; costa twice broke in *Drosophila*), much weakened beyond junction with vein 3, discontinued at ver thickened costal spinules in a single anterodorsal series from proximal break to a l before vein 3, there being an anteroventral series of weak setulae over the same ext more basally costa with several irregular rows of setulae, and with one ventral bristle ab midway between tegula and humeral crossvein; subcosta incomplete distally, ending fa in second costal cell; basal crossvein (between discal and second basal cells) absen position indicated by an unpigmented fold; anal crossvein somewhat thickened and stro recurved; anal cell (CuP) open posteriorly immediately basad of origin of vein 6; vei short, directed posteriorly from posterior border of anal cell. Haltere moderately sl with large, broad capitellum.

Abdomen (♀ only known) broadly oval; tergite 1 joined to tergite 2 on a s sublateral section of each side; tergites 2-6 large; tergite 7 much shorter, and tergite 8 m smaller again, the remaining tergal sclerite (? tergite 9) minute and triangular; sterni quite distinct (vestigial in *Drosophila*); cerci oval, narrowed basally, quite free and wid separated with numerous hairs and a few minute spines; egg guides absent; spiracles 1 situated in pleural membrane; spiracle 7 apparently absent. Spermathecae two, with bi pigmented capsules, each with a cylindrically hollowed base into which the duct is inse only that part of duct within the hollow pigmented.

Type species: *Librella demetrius* n. sp.

In the key to the families of Schizophora of Australia given by Colless McAlpine (1970: 715-719), specimens of *Librella* may generally be taken as couplet 45, where they were included among the "few rare Drosophil (not having a proclinate fronto-orbital bristle) which have precoxal bridge prothorax, no presutural bristle and postverticals convergent". From the drosophilids in this category they are distinguished by the presence of 3 rei fronto-orbital bristles, the non-plumose arista, and the absence of the d basal tubercle of segment 3 of the antenna fitting into a cavity of segme

The name *Librella* is a diminutive of the Latin *libra*, a balance or s scales, and is therefore feminine. It is suggested by the pair of large plate pendent antennae.

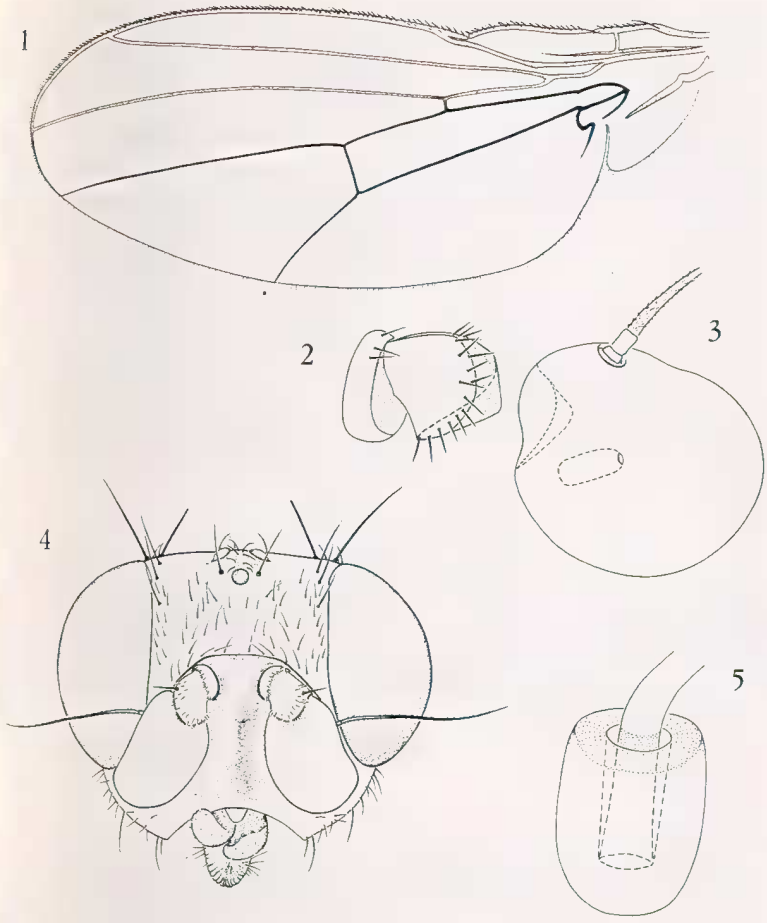
Librella demetrius n. sp.

Figs 1-5, 7, 9, 10

♀. *Colour* light fulvous, most of surface of head, thorax, legs, and abdomen creamy pruinescence, the only dark coloration being a greyish spot between ocelli brown spot at each lateral margin on tergites 2, 3, and 4 of abdomen.

Head. Ocellar bristles subparallel to very slightly divergent, reclinate; vibriss distinguishable from cheek hairs.

Other characters as given in the more detailed generic description.



Figs 1-5. *Librella demetrius*: (1) wing of holotype; (2) antennal segments 1 and 2 of paratype; (3) antennal segment 3 of paratype; (4) head of holotype; (5) cuticular part of spermatheca of paratype.

Distribution: NEW SOUTH WALES — Western Slopes district; AUSTRALIAN CAPITAL TERRITORY.

Type material: Wingabutta Creek, *c.* 37 km N of Mendooran, 27.iii.1971 (holotype ♀, Australian Museum, Sydney), D. K. McAlpine; Black Mountain, Canberra, i,iii.1955-1968 (paratypes, 3 ♀, Australian National Insect Collection, Canberra, 1 ♀, British Museum [Natural History], London), I. F. B. Common.

Additional material. A further 7 female specimens of *Librella* from Black Mountain, Canberra, in the Australian National Insect Collection, exhibit certain characters (some of them quite striking) which disagree with characters

in the above description of *L. demetrius*. As there is no consistency correlation in the various characters, I suspect that these specimens are variants of the one species, *L. demetrius*. However proof of their spec identity must await study of more material.

Some of these additional specimens have the thoracic pruinesce largely grey, and usually such specimens have 3 longitudinal brown stripes on mesoscutum and a dark brown spot on each side of scutellum near its ba Several specimens have antennal segment 3 notably smaller than in the fig holotype. Some have the ocellar bristles directed laterally instead of recli but some show an intermediate condition. Some specimens have 4 or 2 bristles the fronto-orbital series, but in each of these the other side of the head has normal 3 bristles. Such asymmetrical abnormalities in chaetotaxy are fa frequent in the Schizophora. The most curious variant is one specimen in wh a pair of quite strongly developed, but rather short, symmetrical vibrissae present. Presence or absence of a vibrissa is often regarded as a family chara in the acalyptrate Diptera, but in the present case I doubt if it indicates eve specific distinction.

Habitat notes

All examined specimens of *Librella* have been collected at mercury vap lamps in open areas adjacent to dry sclerophyll forest. The localities lie at s distance from the New South Wales coast to the west of the main divi range between the watersheds of the westward and the eastward flowing r systems. These localities lie in the zone of 550-620 mm annual average rainf and are significantly drier than coastal areas of the state. The flora the somewhat drought-resistant, is quite distinct from that of the more arid ce of the Australian continent.

Relationships

(a) Comparison with Heleomyzoidea and Drosophiloidea

On comparing *Librella* with the recognised acalyptrate superfamilies, i found to be most in agreement with the Heleomyzoidea (as defined by Colle and McAlpine, 1970) and Drosophiloidea (defined by Hennig 1958, 1971). T combination of convergent postvertical bristles, uniformly sclerotized face, tw broken costa, and preapical dorsal tibial bristles is apparently restricted to th two superfamilies.

The antenna in the Drosophiloidea has typically a dorsal basal tuber on segment 3 that is concealed in a cavity in segment 2 (Hennig, 1971: 7-10). This is present in all families of the superfamily though it varies in deg of development. Associated with this is a longitudinal slit or groove dors or dorsolaterally on the distal part of segment 2. Although in the superfa Heleomyzoidea the antennae are rather diverse, they are never of the dro philoid type. The basal tubercle of segment 3 is undeveloped and segment 2 no slit in the dorsal part of the distal margin, though it is often sinuate. antennal structure *Librella* again disagrees with Drosophiloidea in having basal tubercle on segment 3 and having a deeply sinuate margin of segment

but there is also a dorsal slit or groove on segment 2 extending almost to its base.

The presence in *Librella* of three reclinate fronto-orbital bristles and no proclinate fronto-orbital is at variance with the Drosophiloidea in which a proclinate and one or two reclinate fronto-orbitals are normally present, but is well within the range of variation for Heleomyzoidea. Within the Drosophiloidea there are numerous apomorphic ephydrid species without the proclinate fronto-orbital, and I am aware of one true drosophilid (related to *Liodrosophila*) which has lost this bristle. In none of these is there an increase in the number of reclinate fronto-orbital bristles, and clearly there is no close relationship between these forms and *Librella.*

The scutellum of *Librella* is strongly reminiscent of that of certain drosophiloids particularly *Camilla* (family Camillidae) and *Leucophenga* (family Drosophilidae). The broad but convex form of the scutellum with its convergent apical bristles makes it remarkably similar in these three genera and unlike any flies outside the Drosophiloidea.

Librella has a broadly triangular prosternum with distinct precoxal bridges. This is much more typical of the Drosophiloidea than the Heleomyzoidea though there are a few examples of this kind of prosternum in the latter superfamily.

The Drosophiloidea have (except where it is much reduced) a highly distinctive type of anal cell (cell CuP) with a thick anal crossvein (free section of vein CuA) curved basad posteriorly, vein 6 more or less obsolete along posterior margin of anal cell, and vein 6 (CuA + 1A) directed posteriorly from its origin well before apex of anal cell. This is precisely the same condition as in *Librella.*

Finally the absence of a differentiated vibrissa is atypical for both the Heleomyzoidea and Drosophiloidea, though a few of the former show a weakening of the vibrissa, and, in the latter superfamily, some ephydrids with reduced chaetotaxy have lost the vibrissa. The presence of definite vibrissae in a single known specimen of *Librella* almost certainly means that some ancestral species possessed these. There is a possibility that this ancestor was remote (comparable to the very remote four-winged ancestor the four-winged mutant *tetraptera* of *Drosophila melanogaster* Meigen). The other alternative, that *Librella* is primitively without vibrissae but occasionally produces an individual in which they are fully developed, is unacceptable from a modern understanding of evolutionary genetics.

From the above it is seen that *Librella* does not fit easily the definitions of either of these closest previously accepted superfamilies though there is some evidence of relationship to Drosophiloidea. An alternative theory of its relationships is therefore considered below.

(b) Comparision with *Cryptochetum*

The family Cryptochetidae includes one living genus, *Cryptochetum*, which has a number of distinctive autapomorphic (*sensu* Hennig) characters which render it conspicuously unlike *Librella*. Nevertheless there is a number of characters in which *Librella* resembles species of *Cryptochetum*.

In considering the morphology of *Cryptochetum* it is necessary to understand that the longitudinal axis has undergone considerable contraction relation to transverse parameters. In *Cryptochetum* the prosternum (Fig. 6) very broadly trapezoid with narrow but well sclerotized precoxal bridges, the greater part of its surface lies in an almost vertical plane. In *Librella* prosternum (Fig. 9) is rather broadly triangular with distinct short precox bridges and lies substantially on the ventral surface of the thorax. The type prosternum in *Cryptochetum* could be derived from that of *Librella* by anteroposterior compression of this region of the thorax. Reference to humeral region of *Cryptochetum* shows that this is precisely the kind modification that has taken place, the humeral calli being much compressed the direction indicated with a large proportion of their surfaces lying on vertical anterior surface of the thorax. In *Librella* a greater portion of surface of the humeral callus faces anteriorly than in *Drosophila*, but tendency is far less marked than in *Cryptochetum*. The preabdomen *Cryptochetum* (Fig. 8) is also affected by this anteroposterior compressi which has resulted in a reduction of tergites 1 and 2.

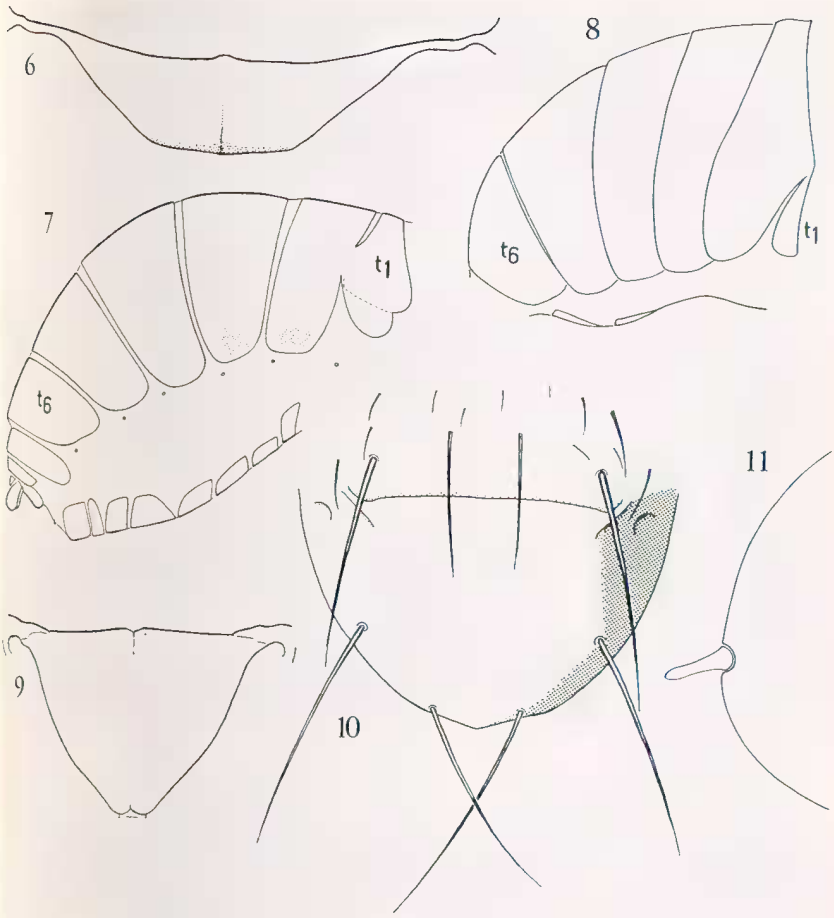
The scutellar suture in both *Librella* and *Cryptochetum* forms a narr and deeply incised groove across the entire median section between the scute bridges, its posterior slope (i.e. anterior margin of scutellum) being particula steep. This contrasts with most examples of Drosophiloidea where this sutu generally forms a shallow groove or rounded excavation. In only a drosophiloids, mainly ones with very convex scutellum (e.g. *Liodrosophila*) condition of the scutellar suture approaches that of *Librella* and *Cryptochet*

The tarsi in both *Cryptochetum* and *Librella* are cylindrical, the termi segment not expanded at all. This is not a consistent difference from Drosop oidea, but many of the latter have the 2 terminal tarsal segments depress

Librella has a bristle immediately behind and above the poster notopleural callus. *Cryptochetum* commonly has 2 or 3 bristles, which may quite strong, in this position. This is a most unusual position for a strong bri in acalyptrate flies. Some *Drosophila* species have a short bristle close to t position as an exceptional condition in the superfamily.

Librella and *Cryptochetum* have also the following characters in comm lower part of head anteroposteriorly compressed making the cheeks a peribuccal region short; face long with a rather long, narrow, and not v strongly raised median carina, which separates the antennal sockets dorsally terminates as a slightly projecting lip in centre of the very well defined lo margin of face; a series of very short cheek bristles, not normally terminating a differentiated vibrissa; palpus rather short but remarkably thick; antenn segment 3 very large and compressed, without dorsal basal tubercle fitting a hollow in segment 2; mesoscutum devoid of strong bristles except towa lateral and posterior margins, but with covering of numerous non-seriate ha costa with 2 breaks; anal cell and vein 6 of characteristic drosophiloid struct (described above); vein 7 (2A) absent without trace.

Many of the abovementioned resemblances between *Librella* and *Cry*



Figs 6-11. (6) *Cryptochetum* sp., prosternum; (7) *Librella demetrius,* abdomen of paratype; (8) *Cryptochetum* sp., preabdomen of ♀; (9) *L. demetrius,* prosternum of paratype; (10) *L. demetrius,* scutellum of holotype; (11) *Cryptochetum* sp., apex of antenna.

chetum are somewhat vague or indecisive, being found in several other families. Hennig (1958) gives a list of 13 characters of *Cryptochetum*, which he considers to be apomorphic in relation to the groundplan of the Schizophora. *Librella* shows clear agreement only with characters 3 (vibrissae absent), 5 (costa broken at end of Sc), 6 (costa broken just beyond humeral crossvein), 7 (basal crossvein absent), 8 (anal cell small and vein CuA recurved, this vein termed "cu_{1b} + 1a" by Hennig), and apparently 12 (seventh spiracle absent in female postabdomen). In character 2 (third antennal segment elongate) *Librella* approaches the condition in *Cryptochetum* in that the third segment is

enlarged. In character 9 (anal vein or vein 6 running close to anal margin wing) a comparison is difficult because of reduction of this vein in *Librella* characters 10 (hypopygium without freely movable surstyli) and 11 (only "Tergitkomplex" between preabdomen and hypopygium) *Librella* is insu iently known for comparison. This leaves only three characters in Hennig with which *Librella* is known to be in total disagreement, viz. characte (antennal arista absent), 4 (fronto-orbital bristles reduced, or, to be more pre fronto-orbital bristles absent), and 13 (abdominal segments 7 and 8 of fe membranous). Further apparently apomorphic characters present in *Cryp etum* but not in *Librella* are as follows: 14, inner and outer vertical bris absent; 15, postvertical bristle absent; 16, ocellar bristle absent; 17, humr bristle absent; 18, sternopleural bristles absent; 19, the usual two outstan notopleural bristles not well differentiated; 20, dorsocentral and acrosti bristles not differentiated; 21, scutellar bristles reduced in size and displ towards apex of scutellum; 22, scutellum sharply margined; 23, abdom segment 1 reduced to lateral vestiges; 24, female postabdomen with a pier apparatus posteriorly.

The only notable character in which *Librella* appears to be m apomorphic than *Cryptochetum* is the much less developed vein 6 in the fore Previously I considered this well developed vein in the anal region of *Cryp etum* to be vein 7 (2A), and the minute spur at apex of the anal cell to be v 6 (CuA + 1A) (see Colless and McAlpine, 1970). On further consideration I feel that Hennig's interpretation is probably correct, and that the former ve vein 6, the minute spur is not the homologue of a longitudinal vein, and t vein 7 is absent (in contrast to Canaceidae, Tethinidae, and the less redu forms of Milichiidae).

The author disagrees with Thorpe (1930) and others who consider arista to be completely absent in the genus *Cryptochetum*. Many species of genus possess a small, basally articulated, peg-like process situated on anterodistal part of the third antennal segment, which I consider to be m probably the arista (see Fig. 11). Thorpe (1930), in placing *Cryptochetum* in family Agromyzidae, appeared to consider this subapical process as homologue of the subapical spine on segment 3 of the agromyzid *Cerodo* Informed opinion no longer considers *Cryptochetum* to be closely related to Agromyzidae. In that family, as well as in other acalyptrates where there subapical spine on segment 3 as well as an arista (e.g. *Lenophila* spp., fa Platystomatidae) the spine is not articulated basally, its cuticle being con uously sclerotized with that of segment 3. In *Cryptochetum* the subterm process is articulated in a membranous socket, as is the arista of other flies. fact that this process is subterminal and unsegmented, instead of sub-basal three-segmented like the usual schizophoran arista presents no difficulty for case. There are numerous examples of terminalisation of the arista in Schizophora, e.g. in the Neriidae, in *Gampsocera* and *Steleocera* (Chloropi in several of the Clusiidae, and in *Cerataulina* and the subfamily Celyph

(Lauxaniidae). *Aulacigaster* is an example of a schizophoran with an unsegmented arista (from author's unpublished studies).

Despite the quantity of the differences between *Cryptochetum* and *Librella* these cannot be taken as strong evidence that the former may not have been derived from a form more closely resembling *Librella*. The differences consist largely of characters in *Cryptochetum* which are apomorphic in relation to those prevailing in the superfamilies Heleomyzoidea and Drosophiloidea, and which were therefore presumably absent in an early ancestral form.

(c) Comparison with *Phanerochaetum*

The Baltic amber fossil *Phanerochaetum tuxeni* Hennig, 1965, was described as a primitive member of the family Cryptochetidae. *Phanerochaetum* shows a significant number of resemblances to *Librella* and its complement of characters is largely intermediate between those of *Librella* and *Cryptochetum*. I consider it to provide important evidence of phylogenetic relationship between *Librella* and the Cryptochetidae (in the currently accepted sense).

The general habitus of *Phanerochaetum* is quite like that of *Librella* and there is also some resemblance in the shape of the head, with broadly excavated upper occiput and ocelli situated right on vertex. Despite the reduction in the cephalic bristles of *Phanerochaetum*, it retains a pair of convergent but rather widely spaced postvertical bristles almost identical to those of *Librella*. The form of the labella and palpi also appears to be similar in the two genera. The antennae show agreement in remarkable detail, despite some lack of detail in the knowledge of *Phanerochaetum*, the only apparent difference being the slight shortening of the arista in *Phanerochaetum*. *Phanerochaetum* agrees with *Librella* rather than *Cryptochetum* in retaining certain distinct thoracic bristles, viz. 1 + 1 notopleurals, a postalar, a posterior intra-alar, a dorsocentral, and a prescutellar acrostichal. The two genera agree closely in wing venation. Hennig (1965) first described *P. tuxeni* as having the anal cell somewhat different from that of *Librella*, but later (1969) described a further specimen of *Phanerochaetum* (?*tuxeni*) in which he was able to confirm that the anal cell and vein 6 are of the type I describe above for *Librella*.

The overall characters of *Phanerochaetum* suggest that it is essentially similar to *Librella* but has undergone some reduction in cephalic chaetotaxy and in the size of the arista, while the scutellar bristles have increased in number and decreased in size, a further modification in the direction of *Cryptochetum*.

Librella may be regarded as a relict form resembling in many characters the ancestral prototype of the Cryptochetidae. Though in many ways it is very similar to the Lower Oligocene *Phanerochaetum*, the latter shares some synapomorphic characters with *Cryptochetum* which are absent in *Librella*. I therefore consider *Librella* to have probably a sister-group relationship to the other two genera, from which it must have separated before Oligocene times, without having subsequently undergone a very noticeable amount of evolution.

The characters differentiating the three genera I now refer to Cryptochetidae are summarised in the following key.

Key to genera of Cryptochetidae

1. The following bristles distinct: inner and outer verticals, ocellar, 3 fronto-orbitals, 2 sternopleurals; arista longer than third antennal segment; Recent, Australia . . . . . *Libre*
   The above bristles absent; arista shorter than third antennal segment, sometimes indistinguishable . . . . . .
2. Arista well developed, closer to base than to apex of third segment; the following bristles distinct: 1 + 1 notopleurals, dorsocentral, prescutellar acrostichal; Oligocene, Europe . . . . . *Phanerochaet*
   Arista minute and subterminal or absent; the above bristles absent or indistinct; Recent, Old World . . . . . *Cryptochet*

Relationships of the Cryptochetidae

Hennig (1958), in laying the foundation for a modern superfa classification of the Diptera Schizophora, placed the Cryptochetidae as a fam of uncertain relationships. He discussed evidence for relationships with superfamily Drosophiloidea, but regarded this evidence as not really cog ("zwingend"). Later (Hennig, 1969) he referred the Cryptochetidae doubtfu to the Milichiodea and in 1973 again placed it among families of doubt relationship.

Griffiths (1972) has postulated that the Cryptochetidae are related to Lonchaeidae, the two families, together forming a monophyletic group, superfamily Lonchaeoidea. This must be examined here as it is not rea reconcilable with the theory that *Librella* is a particularly plesiomor cryptochetid, as *Librella* has less in common with the Lonchaeidae than *Cryptochetum*. Of the characters given by Griffiths for Lonchaeoidea, so (e.g. dark coloration of cuticle, presence of costal break at end of subcosta too widely distributed in the Schizophora to have much significance in context. In characters of reduction (e.g. of fronto-orbital bristles and of postabdominal sclerites) the degree of reduction is different in the two fam and there is no evidence that the more reduced Cryptochetidae passed thro the same reduction stages as the Lonchaeidae.

It is clear that Griffiths misapprehended the nature of the postabdo in *Cryptochetum*. I can confirm from my own studies of an undeterm Australian species of *Cryptochetum* that the basic structure of the male geni in this genus is substantially as figured by Hennig (1937) and that of the fem terminal segments is as figured by Thorpe (1934) except that some detai omitted by the latter. The figures of the aedeagus and associated parts *C. grandicorne* Rondani given by Okada (1956) and that of *C. nippon* Tokunaga given by Griffiths (1972) show the same structure of apparently same Japanese species. But this structure is not the aedeagus but the phall apparatus of the *female* ovipositor, which in this species is longer and m slender than in others examined, but has the same essential structure as *C. grandicorne* as illustrated by Thorpe. Okada even shows the suppos "aedeagus" lying on the large ventral plate, so characteristic of the fem postabdomen of *Cryptochetum*, but males of *Cryptochetum* are without a

similar structure. Though Griffiths' own study of the male postabdomen of *Cryptochetum* is without validity, he is correct in pointing out that there is some kind of connection between the aedeagal apodeme and the hypandrium in both Lonchaeidae and Cryptochetidae. But this connection is of a different type in each family, there being no precise agreement between the two. As is well known the female postabdomen of both *Cryptochetum* and the Lonchaeidae has a piercing organ, and Griffiths is of the opinion that the condition of the female postabdomen in the Cryptochetidae could have been derived from that existing in Lonchaeidae. I cannot agree with Griffiths' view. One of the postabdominal segments of female *Cryptochetum* has a well developed plate-like tergite and sternite. The identity of this segment is hard to determine but it is certainly posterior to segment 6 and it may well be segment 9. In the Lonchaeidae there is no such plesiomorphic segment in the postabdomen and segment 9 is almost certainly part of the piercing organ or aculeus. The piercing organ of *Cryptochetum* does not appear to be homologous with that of the Lonchaeidae and is very different in its basal structure and connections. The structure of the female postabdomen of Lonchaeidae is so precisely similar to that occurring in the Tephritoidea (Otitoidea) (*sensu* Colless and McAlpine 1970) that I find it hard to believe that the similarities are not due to synapomorphy.

The structural difference in the female postabdomen between Lonchaeidae and Tephritoidea given by Griffiths does not really exist, as many of the Tephritoidea have flexible cuticular rods extending posteriorly from the body of segment 7 (D. McAlpine, 1973). Griffiths' difficulty in accepting a relationship between Lonchaeidae and the Tephritoidea lies in a failure to understand the extreme plasticity of male postabdominal characters in the Schizophora. There is evidence of variation among closely related forms in the disposition of the protandrial sclerites and even more evidence for such variation in aedeagal structure (see D. McAlpine 1967 for variation in the aedeagus within one tribe of Heleomyzidae). The pyrgotid genus *Commoniella* is an example of a tephritoid fly with exceedingly short, non-coiled aedeagus, yet this genus is undoubtedly correctly placed systematically.

Griffiths gives as apomorphic characters of the groundplan of Lonchaeoidea the cleft second antennal segment, the downwardly directed third segment, and the sub-basal arista. Griffiths' application of these characters to the Cryptochetidae is due to the characters of the fossil *Phanerochaetum* as *Cryptochetum* has no cleft or even a trace of a notch in segment 2 and no sub-basal arista. I seriously doubt if the character of the sub-basal arista is apomorphic in relation to the groundplan of the Schizophora. All three of these antennal characters are shared by a multitude of other schizophorans including a substantial percentage of the Calyptrata, Tephritoidea, and Drosophiloidea. They cannot therefore be phylogenetically significant in the present context.

I summarise my views on the supposed relationship between Lonchaeidae and Cryptochetidae by stating that: (1) the genuine points of resemblance are of such wide occurrence in the Schizophora as to render them useless as indicators of close relationship: (2) the difference in structure of the female postabdomen between the Lonchaeidae and *Cryptochetum* is so great as to

render any close relationship very improbable and the derivation of the one p of postabdomen from the other incredible: (3) the relationships of Lonchaeidae are probably with the Pallopteridae and the Tephritoidea, w the Cryptochetidae are not referable to this complex.

Taking *Librella* as approximating to the archetype of the Cryptochet I consider that the balance of evidence discussed above indicates a prob relationship to the superfamily Drosophiloidea. The absence in *Librella* o dorsal basal tubercle, characteristic of but not restricted to the Drosophil is difficult to interpret in phylogenetic terms. Possibly the structure has secondarily lost. On the other hand it is possible that the Cryptochetidae e possessed the differentation of the fronto-orbital bristles into reclinate proclinate elements characteristic of the archetypes of all families of Dros oidea admitted by Hennig.

The family Cryptochetidae should probably therefore be assigned isolated position in the superfamily.

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